

THE TAPANUI REGION OF NEW ZEALAND : SITE OF A 'TUNGUSKA' AROUND 800 YEARS AGO?

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Summary

We discuss the evidence that the wide-spread fires *ca.* 800 years ago which denuded the southern provinces of the South Island of New Zealand of the extensive forests present at that time were due to the entry of a large bolide into the atmosphere, the conflagration being ignited by the intense heat generated as this extraterrestrial projectile ablated/detonated in a similar manner to that of the Tunguska object of 1908. These fires led to the extinction of the giant terrestrial bird known as the Moa, and the end of the archaic epoch of Maori history known as the *Moa Hunter* period. This interpretation is well attested to in Maori myth and legend.

Introduction

The fact that the Earth is struck quite frequently by astronomical objects of substantial size is now well-established (*e.g.* Shoemaker, 1983). The last time that a large body was observed to intrude into the terrestrial environment was when a $\sim 10^{12}$ g object entered the atmosphere over the Tunguska region of Siberia in 1908, this apparently having been a part of the Taurid Complex (Kresák 1978; Steel *et al.*, 1991), whilst the expected 'annual event' (a ~ 20 kilotonne TNT-equivalent explosion) corresponds to an incoming mass of order 5×10^8 g (Table 2 of Ceplecha, 1992). The frequency of Earth-encounters with objects of such a size and energy as the Tunguska event progenitor (assuming that such events occur stochastically, which would not be the case if such objects are members of a coherent complex: Steel, 1991) is of the order of every few centuries or so (Shoemaker *et al.*, 1990). It is noteworthy that recent observations with the *Spacewatch* telescope (the first of ~ 10 - 100 m-sized objects) indicate this size region to be rather more populous than previously thought (Rabinowitz, 1992), and those data have been used by Ceplecha (1992). Since mankind obviously has a vested interest in finding out more about the effects of such impacts (using that word advisedly since the Tunguska object detonated in the atmosphere and did not reach the surface: Krinov, 1963) it is of importance to identify other areas of our planet which have been subjected to such violations in the recent past (the last few millenia). In this paper it is suggested that the southern part of the South Island of New Zealand may have been the target of such a projectile about 800 years ago, so that a scientific study of the region is warranted.

New Zealand context

Near the town of Tapanui in the province of Otago is a structure known as the Landslip Crater or Landslip Hill (location $169^{\circ}09'$ East, $46^{\circ}04'$ South). This feature is an incomplete ovoid crater measuring 900 by 600 by 130 metres deep, which geological interpretation points to being a landslide (Lindqvist, 1990) and not a scar formed by an impact upon the Earth's surface of a large solid body, as such. Although this is apparently not an impact crater there exists *prima facie* evidence that links this site to a major cataclysm around 800 years ago. It is well-known that there were widespread fire(s) at about that time, possibly followed by a deluge, and this has usually been ascribed to the indigenous Maoris burning specific areas to drive the now-extinct Moas (*Dinornis*: a ratite) from the forests (Stevens *et al.*, 1988). Whilst in the North Island of New Zealand the forests at the time of the arrival of the first Polynesians (*ca.* 925 AD) were predominantly of broadleaf trees with few Moas present, in the South Island the forests were of podocarps which completely covered the island up to the treeline of the Southern Alps (Molloy *et al.*, 1963). In this environment the Moa flourished. Carbon dating of the charcoal which now pervades the soils

of the southern provinces (Southland, Otago and Canterbury) indicates that these fires occurred 600–1000 years ago with a clustering at *ca.* 800 years, although some burning may have occurred earlier, prior to the arrival of humans about a thousand years ago (Molloy *et al.*, 1963).

The 'conventional wisdom', then, says that the Moa was driven to extinction by the Maoris who hunted them by setting the fires: the Moa were deliberately driven with the flames into swamps, where many Moa remains are now found. If this is what actually happened then the newly-arrived Maori would have cut off one of their major sources of food, and ruined a stable environment (this area of New Zealand is now denuded of forests and is open hill-sheep country). Maori history is quite clearly divided into the early *Moa Hunter* or *Archaic* period, and the later *Classic Maori* period; the major inland Moa-hunting area covers the Tapanui region (Stevens *et al.*, 1988: p.117). Both archaeological evidence and spoken Maori history indicate that there were intermittent arrivals of peoples from Polynesia between 925 and 1150 AD. The 'Great Migration' which began *ca.* 1350 AD apparently (again from Maori legend) post-dates the extinction of the Moa.

However, there is some evidence that indicates a rather more coherent event than might be expected from gradual forest-burning. Snow (1983) states that the tree fall distribution from that period points radially away from the Tapanui site. Pajak (1989, 1990) claims that fallen trees are aligned radially *away* from this site out to a distance of 40–80 km, and then tend to point radially *inwards*, and suggests that this may be due to an explosion at Tapanui blasting the closer trees outwards, with the upwelling from a firestorm after the blast resulting in the inward falls. These suggestions require scientific study, and the dates of tree falls also require elucidation (it would seem remarkable if fallen trees from such antiquity still existed in large quantities).

Pajak (1989, 1990) also states that small globules of silicates which he terms *trinitites*, presumably taking their name from similar samples found around the Trinity (New Mexico) site after the first anthropomorphic nuclear explosion in 1945, are found thereabouts and that these are also evidence of a cataclysmic explosion, which he attributes to an extraterrestrial spacecraft. The conventional geological explanation would be that these are from some volcanic explosion, or are similar to tektites. There is also an abundance of *sarsens* or *Chinamen stones* spread across the vicinity, these being made of quartz sandstone. Pajak (1989, 1990) believes these to have been metamorphosed under high temperature and pressure conditions in his explosion as mentioned above, whilst Snow (1983) ascribes them to a bolide entering the atmosphere and breaking up, possibly after ejection from a lunar impact. Lindqvist (1990) identifies these as being made of fluvial quartz sandstone and conglomerates which have been silica-cemented, so that they are clearly produced by normal terrestrial processes, and apparently not related to the effects of an incoming asteroid or comet, if such did in fact occur.

Maori oral history

There is also the evidence of Maori myth, legend, poetry and song which speak of the falling of the skies, raging winds, upheaval of the Earth, and mysterious devastating fires from space. Many local place names may be translated in terms of a catastrophic event having occurred thereabouts, and Tapanui itself apparently means *The big explosion* or *The big devastating blow*: there is a Maori adage that "The history is in the names, and the names are in the land". Another nearby site is *Waipahi*, which may be taken to mean *The place of the exploding fire*. Other similar place names exist in abundance, and do not appear commonly elsewhere in New Zealand. Snow (1983) has listed many of these possible interpretations, and Maori mythology is rife with connections between these fires, the end of the Moas, and an object falling from the Moon or space. In fact the word *Moa* is relatively recent; in the early Moa Hunter epoch prior to the fires the animal was termed *Pouakai*, but afterwards it was remembered as *Manu Whakatau*, one translation of which is *The bird felled by strange fire*. Again, one Maori lament states that:

“Very calm and placid have become the raging billows,
That caused the total destruction of the Moa,
When the horns of the Moon fell from above down.”

The idea that the Moa expired in some natural conflagration is not a new one. Hill (1913) argued for the North Island Moa being destroyed in the aftermath of a volcanic eruption or something similar, and quotes a conversation with an eighty-eight year old Maori chief: “The Moa disappeared after the coming of Tamaatea [a man/god] who set fire to the land. The fire was not the same as our fire but embers sent by Rongi [the sky]. The signs of the fires are still to be seen where red rocks like berries are found.”

Since Maori legend unambiguously indicated the period at which the widespread fires occurred, and the time at which the Moa died out, and this oral tradition was later verified by modern Carbon-14 dating and botanical techniques, it would seem plausible that Maori myths may also contain at least their own interpretation of the origin of these fires. “It is my belief that hidden in Maori mythology there is also a message about the catastrophic nature of our past” (Snow, 1983).

Astronomical interpretation

As a baseline hypothesis, which in the best traditions of scientific practice requires a disproof, we adopt the idea that this structure at Tapanui is the scar produced by the detonation of a large bolide in the atmosphere *à la* Tunguska, and the forest fires were ignited by this cataclysmic event. How does this fit in with present-day ideas of terrestrial catastrophism?

One of the authors [D.S.], in collaboration with others, has advanced the hypothesis that in the present epoch the Earth is subject to episodes of substantial influx by macroscopic bodies, these being the debris produced by the break-up of a Giant Comet in the past 10,000–20,000 years. The various phenomena now seen (recurrent meteor showers, P/Comet Encke, several Apollo asteroids) are collectively termed the *Taurid Complex*. We believe that the core of this complex, under orbital precession, intersects our planet for four periods lasting a century or so, these four epochs being spread over a cycle time of a few thousand years (see Steel *et al.*, 1991). One such period was apparently at the start of the present millenium (Bailey *et al.*, 1990; Clube and Napier, 1990), and thus seems to correlate with the time of the entry of the bolide above New Zealand, if our hypothesis is correct. This also correlates with the putative time of the formation of the Giordano Bruno crater on the Moon (1178 AD: Hartung, 1976; Clube and Napier, 1990) which Snow (1983) linked into his baseline model of a large asteroidal impact; such an event within the last millenium seems to be an unlikely occurrence.

Yet another nearby place name is Otarehua, where ‘Ota’ means ‘of the’ and ‘rehua’ was the Maori name for Antares, the (northern) summer star. This may help to indicate the time of year at which the bolide entry occurred: perhaps near the northern mid-summer (austral mid-winter), when the daytime Taurid intersection with the Earth is most active and the Tunguska event occurred. Other place names may indicate the day in the lunar cycle when the New Zealand catastrophe happened, although without definite knowledge of the year this is not of use in fixing the date.

Whatever the source of the bolide which arrived in the atmosphere above the southern part of New Zealand about 800 years ago, if this is what actually occurred then the area would be of fundamental import in developing our understanding of the response of the Earth to such large insults. The purpose of this paper is to bring the site to the attention of scientists with expertise in the various areas which would be necessary for a rigorous study of the area, in order to show whether or not a Tunguska-type event did occur there around the twelfth century, and if so what may be learnt from it.

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Post-conference addition: After the presentation of this paper I [D.S.] was abashed to be informed by E.F. and R. Helin that a similar myth exists amongst the Australian aborigines of western New South Wales (E. Jones, The Story of the Falling Star, Aboriginal Studies Press, Canberra, 1989). This tells of a foretold falling star bringing fire and havoc as it shot through the skies, killing many people and depositing strange stones, again with a following deluge. The stones shown in that book are clearly non-meteoritic in origin (R.H. McNaught has visited the indicated site and found those rocks to be marble) but this may be due to confusion after centuries of story-telling.